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TWO NEW AXIID (CRUSTACEA: DECAPODA:  
THALASSINIDEA: CALOCARIS) FROM NORTH  
CAROLINA AND THE STRAITS OF FLORIDA

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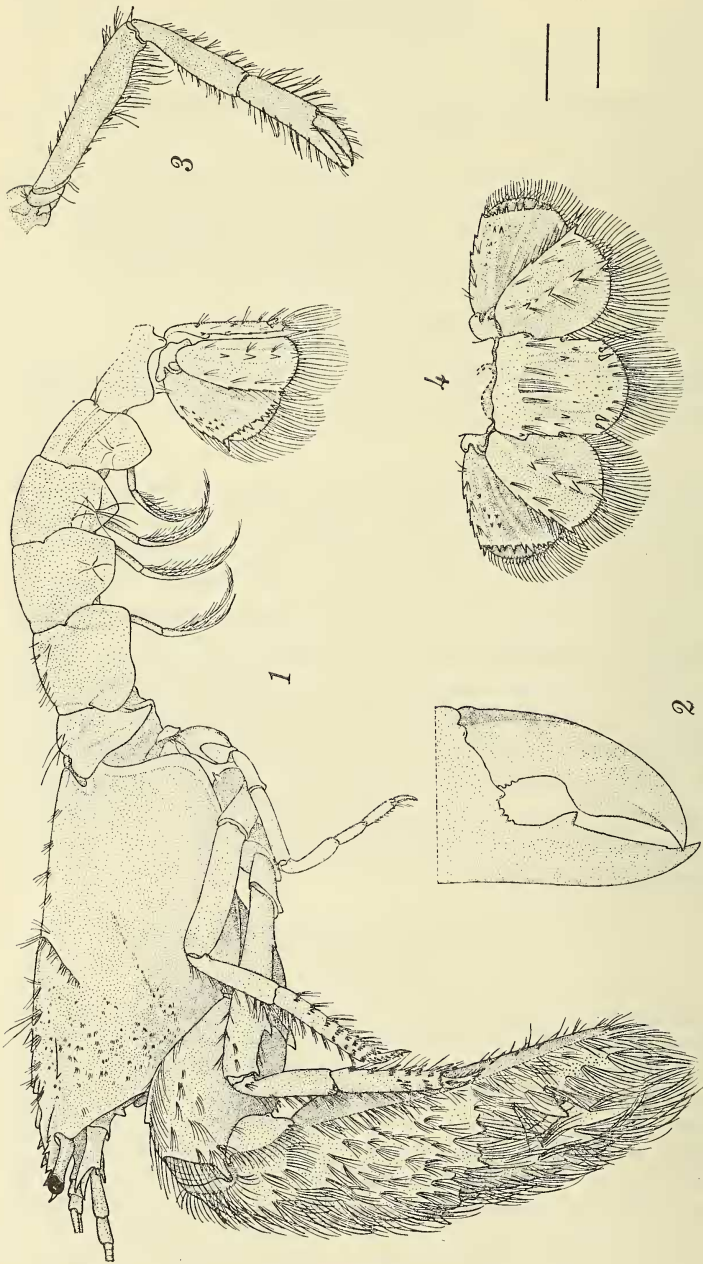
Benthic biological sampling near the edge of the continental shelf off Cape Lookout, North Carolina, during cruises of the Duke University, NSF-sponsored, R/V *Eastward* has produced a few specimens of a new species of axiid "lobster" belonging to the genus *Calocaris*. A second new species, represented by a single specimen from the western edge of the Bahama Bank, was taken during deep-water shrimp exploration with a 40-foot flat trawl in the Straits of Florida by the then U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries vessel *Combat*. These species added to the four North Atlantic Axiidae discussed by Boesch and Smalley (1972) reinforce their conclusion that the genus *Calocaris* as now constituted represents more than one group.

***Calocaris (Calastacus) jeneri*, new species**

Figures 1-10

*Holotype male*: Integument microscopically granulate. Carapace compressed; nearly smooth, scattered rugosities anteroventrally on branchiostegite and cephalic part; almost straight along middorsal line in lateral view except gradually deflexed from gastric region to tip of rostrum; midline narrowly rounded and elevated posteriorly but not keel-like; cephalic groove obsolete ventrolaterally; branchial groove inconspicuous; branchiostegite emarginate ventrally and posteriorly; scattered setae overall but tufts anterior to branchial region, densest on gastric region.

Rostrum slightly exceeding eyes, tip upturned but no larger than any of 3 asymmetrically spaced marginal spines on each side; with low



FIGS. 1-4. *Calocaris (Calastacus) jenneri*, holotype male: 1, lateral view; 2, fingers of minor chela with setae removed, inner view; 3, second leg; 4, tail fan. Scales = 2 mm. Scales = 2 mm: upper, 1, 3, 4; lower, 2.

median dorsal, interrupted keel reaching from level of midlength of eyestalks to cephalic groove; ventrally with fairly deep median keel; notched laterally at base where rostrum merges with gastric region (orbit) for reception of eyestalks in erect position.

Gastric region with 2 dorsal carinae on each side of middorsal keel more or less interrupted by spines and gaps; lateral pair interrupted at about midlength by blunt spine, but continued to near base of rostrum, ending in low ridge on left but a broken spine on right at base of rostrum; row of scattered tubercles between middorsal keel and submesial carinae.

Abdomen and telson together about 1.5 times length of carapace (parts of segments 4-6 broken). Segments smooth and almost uniformly arched transversely (but with low lateral carina most prominent and oblique on first segment, becoming obsolescent posteriorly), bearing scattered clumps of long, fine setae; first segment short, fitted for articulation with carapace, with pleuron drawn posteroventrally to acute tip; pleura of second to fifth segments with anteroventral margins broadly rounded, ventral margin of second and third nearly straight, posterior corners of 2-5 nearly rectangular; sixth with broadly rounded pleuron.

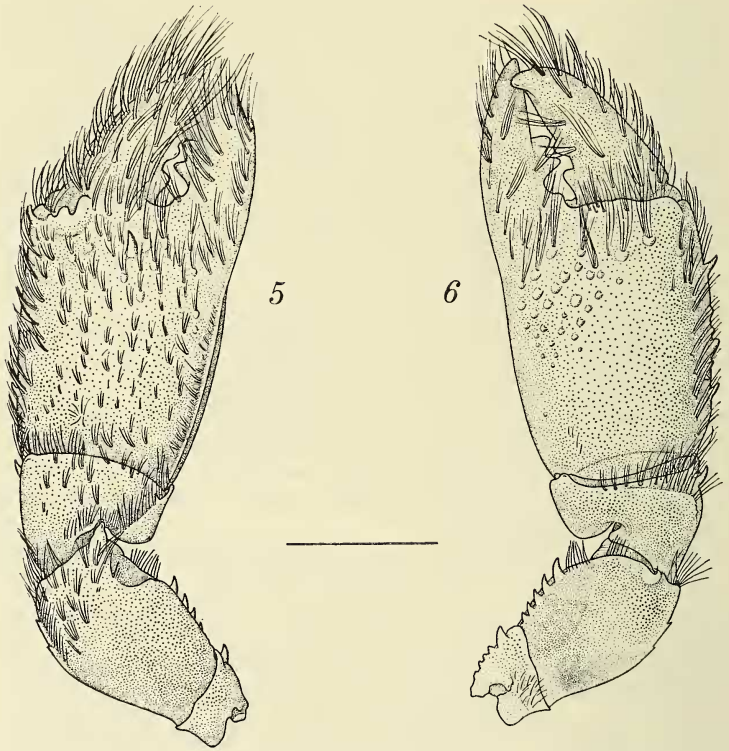
Eyestalks almost cylindrical, slightly flattened mesiodorsally, cornea well developed.

Antennular peduncle with second article almost reaching tip of rostrum.

Antennal peduncle with penultimate article extending beyond antennular peduncle; first (coxal) article with a short ventral spine; strong dorsolateral spine of second article reaching proximal border of cornea; antennal thorn (acicle) slender, curved, exceeding cornea and reaching distal border of penultimate article of antennular peduncle; third article with slender mesioventral spine reaching about  $\frac{1}{4}$  length of fourth article; terminal article about  $\frac{3}{5}$  length of fourth article; flagellum reaching beyond chelipeds, but broken.

Endopods of third maxillipeds pediform, densely setiferous ventrally and mesially; distal article unarmed; merus with 3 ventral spines progressively larger and more acute distad; ischium with 2 small spines on ventral margin proximally, and along mesial margin a prominent crest of about 17 strong spines terminating in distally advanced spine curved mesad; coxa with ventral spine.

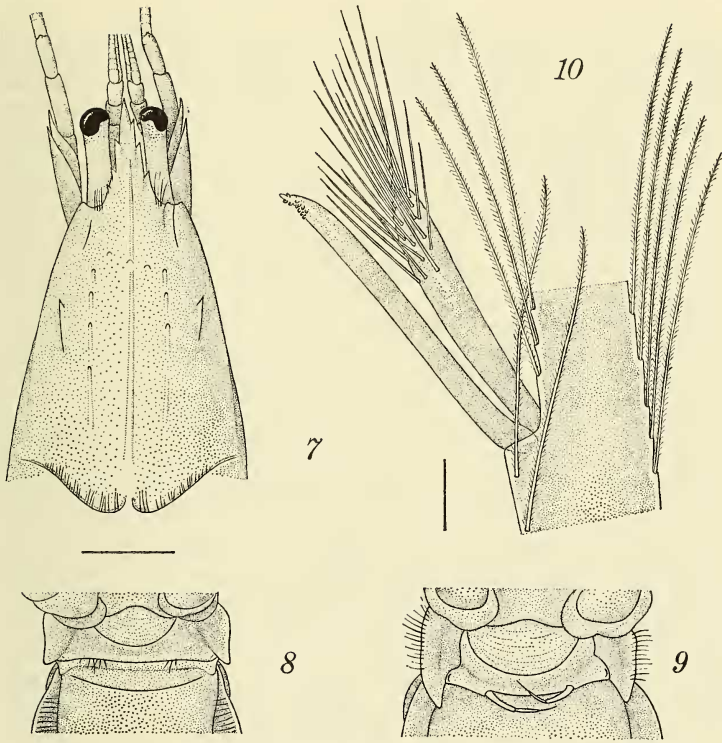
First legs strong, chelate, asymmetrical; with numerous tufts of conspicuous, silky, plumose setae obscuring fingers on both inner and outer surfaces, becoming progressively shorter to crest of merus on outer surface but leaving inner proximal part of hand bare; submarginal row of setae on inner face of carpus and ventral border of merus. Right chela strongest, fingers stout; fixed finger nearly straight, crushing edge with small proximal tooth and larger bilobed tooth distally; dactyl curved, tip closing inside fixed finger, strong tooth opposing bilobed tooth of fixed finger and a stronger tooth proximal to it; crest of propodus with few spines and tubercles, inner face with patch of strong tubercles near base of fixed finger; carpus with sharp dorsal spine at articulation with hand;



FIGS. 5-6. *Calocaris (Calastacus) jeneri*, major (right) chela of holotype male: 5, external view; 6, internal view. Scale = 5 mm.

merus with upper margin keeled, low tooth near crest and row of 5 spines on proximoventral margin. Left chela similar except more slender and shaped as cutter; fingers agape proximally, distal half with opposed edges straight and finely serrate; prominent triangular tooth at middle of fixed finger diverging outward from cutting edge, opposite it an internal shoulder on dactyl; low rounded teeth on both fingers near articulation of dactyl; externally, and nearly concealed in pubescence, a prominent row of coalesced tubercles and spines parallel to proximal margin of fixed finger near articulation of dactyl; tubercles at bases of setal tufts on inner palm proximal to fixed finger.

Second legs chelate (left missing), flattened, merus with 3 unequal ventral spines; fingers corneous-tipped, cutting edges with fine spinules most dense distally, arranged full length of fixed finger, only on distal half of dactyl; dense tufts of setae on fingers and longer tufts of setae on margins elsewhere.



FIGS. 7-10. *Calocaris (Calastacus) jenneri*: 7, anterior carapace in dorsal view, holotype male; 8, sternite of first abdominal segment and adjacent parts, holotype; 9, sternite of first abdominal segment, allotype female; 10, appendices interna and masculina with part of second pleopod, paratype male (UNC-IMS 2484). Scales: horizontal, 7, 8, 9 = 2 mm; vertical, 10 = 0.2 mm.

Third and fourth legs similar, flattened; dactyls slightly curved, a comb of corneous spinules laterally, 3rd with 5 on left, 6 on right, 4th with 6, tips corneous; propodus with combs of corneous spinules ventrolaterally, 3rd with 7, 4th with 8 on left, 9 on right, and 3 or 4 smaller accessory combs laterally; scattered setae on all articles.

Fifth legs smaller in diameter as well as length, cylindrical; dactyl curved, corneous-tipped, with spinules laterally and on propodus distally; scattered setae longest and densest distally.

Biramous, setose pleopods on abdominal segments 2-5, lacking on first segment; endopod of each with appendix interna equipped with hooked setules at tip; second pleopod with an appendix masculina bearing long non-plumose setae on distal third (appendix missing from left side).

Tail fan with dense, long, plumose setae on caudal margin and tufts elsewhere. Telson longer than broad, with submesial pair of thickened longitudinal ribs; caudal margin evenly rounded, lateral margins with proximal lobate process articulating with mesial branch of uropod and interrupted distally by 3 progressively more closely spaced spines; submarginal spine each on marginal process, at base of first marginal spine (movable), mesial to it on submesial rib (fixed), and an unequal pair near distolateral corners (movable). Uropods as long as telson. Mesial branch with thickened longitudinal ribs bearing 4–5 spines, lateral margins with 2–4 spines progressively longer distally. Lateral branch with transverse distal suture bordered by row of strong, fixed spines; submarginal movable spine at distolateral corner; 2 thickened longitudinal ribs, lateral one broadest and bearing scattered small spines; lateral margins with 2–4 spines and slight unevenness distally.

*Allotype female*: Much as holotype in general appearance but differing as follows: Rostrum with asymmetrical marginal spines, 2 on left, 1 plus rudiment on right. Ridging and tuberculation of gastric area less pronounced. Both chelae somewhat less setose and less tuberculate. Major chela with dactyl closing completely inside fixed finger, tips crossing; fixed finger with a prominent tooth near midlength and 3 low ones proximally, shearing edge distally with 1 low broad tooth; dactyl with broad, low proximal tooth, a notch distal to it followed by smooth shearing edge. Minor chela with fingers separated by narrower proximal diastema, distal shearing edges of fingers faintly serrate; single sharp spine on external surface of palm proximal to articulation of dactyl. Small uniramous pair of pleopods on sternite of first abdominal segment; pleura of 4th and 5th segments more acutely tipped.

*Measurements in mm*: Holotype ♂. Carapace: length including rostrum, 12.4; width, 6.3; height, 6.3. Length articles of legs, L = left, R = right:

	1R	2R	3L	4L	5L
dactyl	6.9	1.9	1.5	1.4	1.1
propodus	14.4	4.3	3.8	4.1	3.8
carpus	4.4	4.3	3.6	3.3	2.6
merus	6.5	7.0	6.9	5.0	3.5
total	32.2	17.5	15.8	13.8	11.0

Allotype ♀. Carapace: length including rostrum, 10.5; width, 4.4; height, 4.6. Right chela: length dactyl, 4.0; propodus, 7.9.

*Type-locality*: E Cape Lookout, N. C., 34°18'N, 76°01.2'W–34°17.1'N, 76°01.3'W, 100–85 m, *Eastward* Stn. 12885, Cape Town dredge, 3 October, 1969, C. E. Jenner and class.

*Material studied*: Specimens studied are confined to the type series deposited in collections of the National Museum of Natural History (USNM), Washington, D.C., and University of North Carolina Institute of Marine Sciences (UNC-IMS), Morehead City, N. C.

USNM 150472 holotype ♂; USNM 150474 allotype ♀, paratype ♂ (cl 7.5 mm [est., rostrum broken], cl 8.4 mm), SW Cape Lookout, N. C., 33°43.1'N, 76°40.7'W–33°43.4'N, 76°40.3'W, 100 m, *Eastward* Stn. 1089, small biological trawl, 27 April, 1965, Menzies. UNC-IMS 2484 paratype ♂ and ♀ (cl each 11.3 mm), E Cape Lookout, N. C., 34°43'N, 76°40'W–33°42.7'N, 76°40.2'W, 90–110 m, *Eastward* Stn. 1087, small biological trawl, 27 April, 1965, Menzies. USNM 150473 paratype ♂ (cl 9.6 mm), SSW Cape Lookout, N. C., 33°43.3'N, 76°42'W–33°44'N, 76°41'W, 91–98 m, *Eastward* Stn. 10789, Cape Town dredge, 4 November, 1968, J. and W. Vernberg.

*Variation:* Ornamentation (setae, tubercles, spines) increases in size and complexity with increasing body length. In one male (USNM 150473) the proximal tooth of the major propodal finger is fairly well developed, but other teeth are rudimentary. The diastema on fingers of the minor chela is also well developed in this specimen, but it is not pronounced in smaller specimens examined. The hands of this male are reversed, the left stronger, but there is no evidence of alteration in the minor chela to indicate regeneration. The rostrum may be symmetrically or asymmetrically toothed.

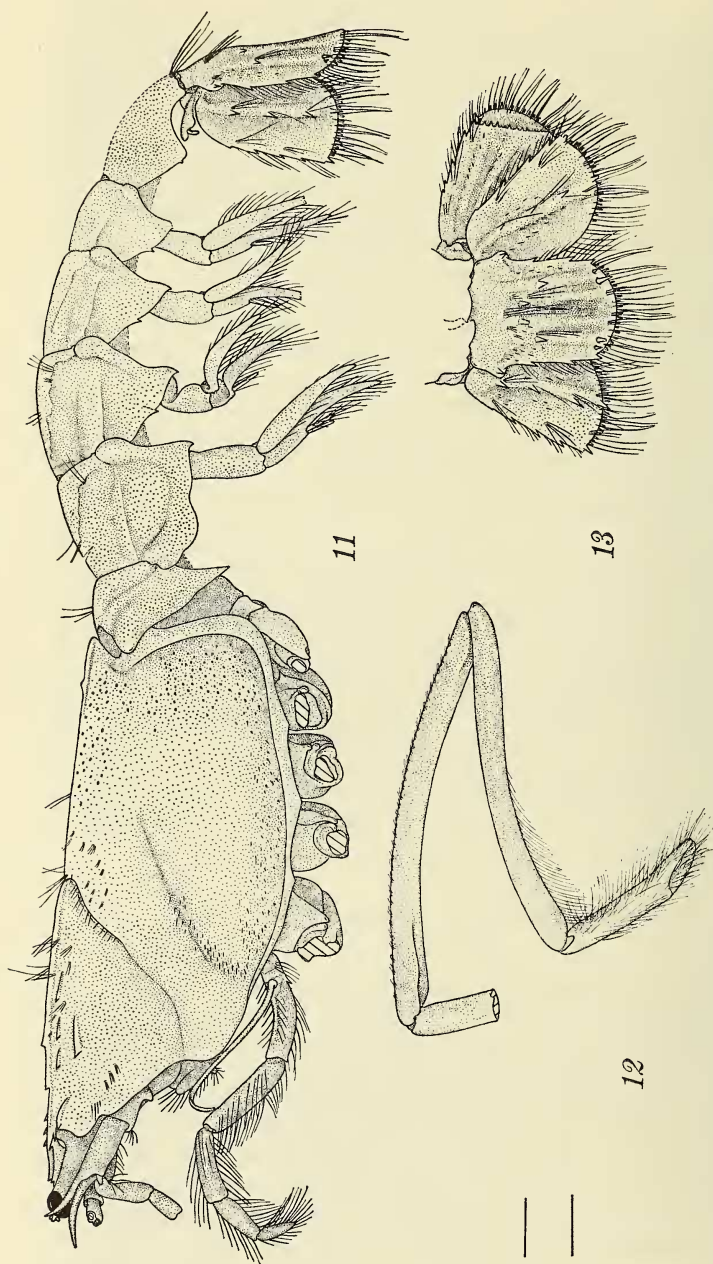
*Color in life:* Ground color "flesh" to off-white (pinkish white) with longitudinal trending, cross-banded spots of orange-red. Most dense orange-red color on posterior part of carapace where red is also deepest in intensity. Abdomen with first segment pale, others progressively darker caudad; lightest areas at articulations dorsally, deepest colors at bases of pleura. Basal articles of antennules and antennae with bands of color equal in intensity to darker parts of abdomen. Color on legs more washed out. Pubescence light greenish tan. (From holotype.)

*Name:* This species is named in honor of Professor Charles E. Jenner, Department of Zoology, University of North Carolina, Chapel Hill, who has contributed much to knowledge of marine invertebrates of the Carolinas and who with one of his classes collected the holotype.

### **Calocaris (Calastacus) oxypleura**, new species

Figures 11–18

*Holotype male:* Integument microscopically granulate. Carapace compressed; bearing a sparse, short pubescence in tufts originating from rather evenly scattered, nearly obsolescent tubercles, longer setae on gastric region and in grooves; almost straight along middorsal line in lateral view except rostrum very slightly deflexed; most broadly rounded dorsally in gastric region, narrowing posteriorly; midline slightly raised, almost keellike in short section near posterior margin but interrupted at cervical groove, posterior part of gastric region and middle of posterior carapace; cephalic groove deepest dorsally but evident throughout length; branchial groove obsolescent but forming broad, shallow depression.



FIGS. 11-13. *Calocaris (Calastacus) oxypleura*, holotype male: 11, lateral view; 12, second leg; 13, tail fan. Scales: upper, 11, 13 = 2 mm; lower, 12 = 1 mm.



Rostrum slightly exceeding eyestalks, tapered and narrow; edges upturned; tip slightly damaged but apparently ending in an upturned spine approximately equal to pair of adjacent marginal spines, behind these a pair of slightly larger spines at midlength, and at broadening base a still larger pair; marginal notch (orbit) at base for reception of eyestalks in erect position where rostrum merges with gastric region.

Gastric region with 2 interrupted carinae on each side of raised midline; midline with moderate anterior spine followed by obsolescent spine; each lateral carina originating in diverging rostral base and armed with 3 buttressed spines, 1 above ocular notch, 1 behind notch, and 1 remote posterior spine; each submesial carina consisting of 3 remote buttressed spines in nearly straight line; area between carinae smooth except for scattered tufts of setae.

Abdomen and telson together about 1.5 times length of carapace (parts of abdominal segments 2-6 badly broken); segments smooth and uniformly arched dorsally, first short, fitted for articulation with carapace; low discontinuous longitudinal carina laterally between segmental articulations; pleura of segments 1-5 drawn posteroventrally to acuminate tips and with uniform margins except as follows: anterior margin of first segment slightly sinuous, of long second segment quite sinuous, of segments 3-5 with single spine in middle; sixth segment with pleuron subrectangularly produced, a tiny blunt spine anterior to tip of pleural lobe.

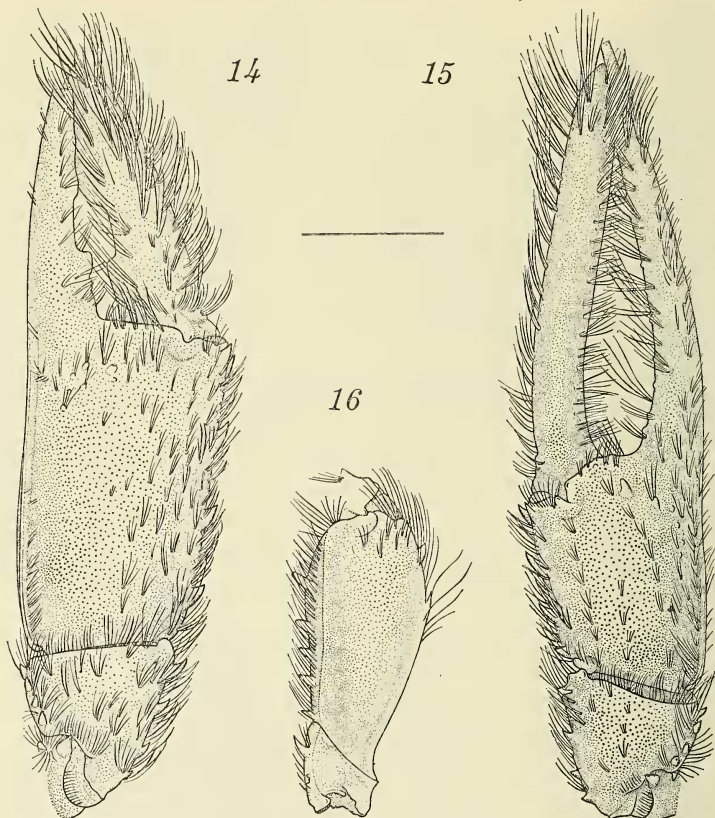
Eyestalks slightly flattened mesiodorsally, left slightly longer than right; cornea dilated.

Antennular peduncle with second article reaching anteriorly to same level as tip of rostrum (estimated rostral length).

Antennal peduncle with penultimate article extending beyond antennular peduncle; first (coxal) article with short, slender, terminal ventral spine; strong dorsolateral spine of second article reaching beyond distal margin of cornea; antennal thorn (acicle) slender (bent unnaturally) exceeding antennular peduncle; third article with small, distal, mesioventral spine; terminal article  $\frac{1}{2}$  length of penultimate fourth article; flagellum missing.

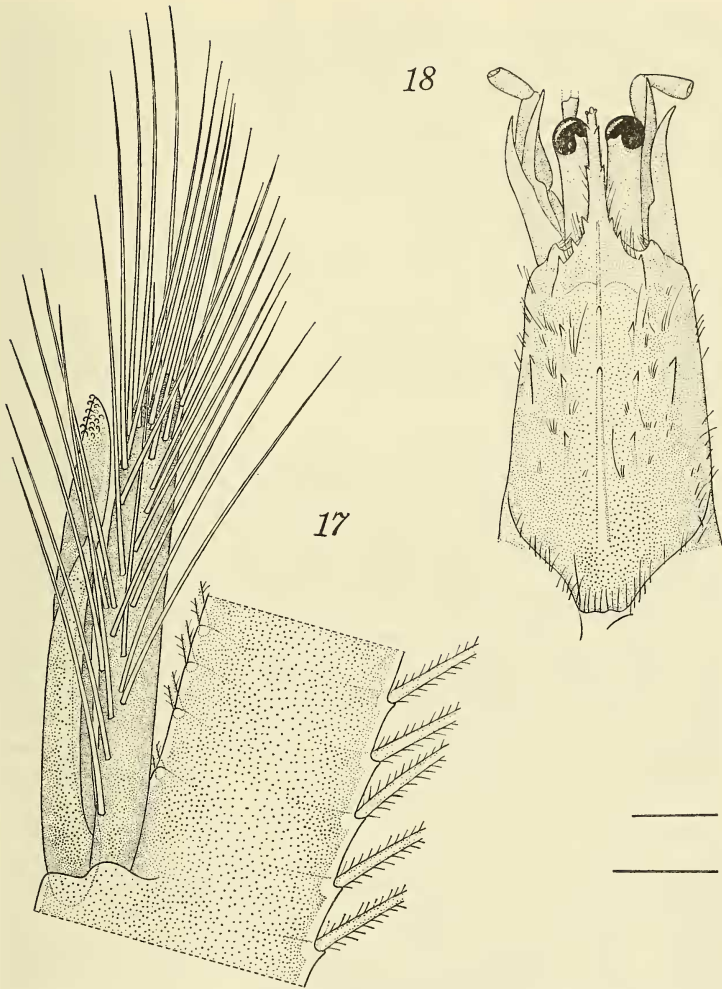
Endopods of third maxillipeds pediform, densely setiferous ventrally and mesially, a few long setae on carpus and merus laterally; distal articles unarmed; carpus with small distoventral spine laterally; merus with 3 ventral spines progressively larger and more acute distad; ischium with 2 small spines on ventral margin, and along mesial margin a prominent crest of about 16 spines terminating in an enlarged distal spine curved mesad; coxa with ventral spine.

First legs strong and asymmetrical, chelae elongate. Each rather thinly clothed with tracts of conspicuous, tufted, long setae, thickest on dactyls (but nearly as thick on fixed finger of right chela), dorsal aspect of palms, external surface of carpus and distal exposed part of merus; sparser but equally long tufts on inner surface of palms (except central inflated part), in row along groove on ventrolateral margin of



FIGS. 14-16. *Calocaris (Calastacus) oxypleura*, chelae of holotype male in external view: 14, left; 15, right; 16, right merus. Scale = 5 mm.

hands, and on ventral edge of merus; tufts more evenly distributed on right than on left chela. Each hand with: row of 4 nearly equidistant spines on dorsal margin of palm and laterally displaced one near articulation of dactyl; tracts of irregularly sized tubercles on both inner and outer surfaces of palms, distally near base of fixed finger (one spiniform tubercle on each surface of right chela much larger and sharper than remainder) and trailing posteroventrally, especially on inner surface; low but sharp ridge along ventrolateral margin, sharpest proximally but diminishing to obsolescence near tip of fixed finger. Right chela slender, fingers agape nearly throughout length but tips broken; dactyl stouter than fixed finger, its prehensile edge with fine but uneven serrations most dense distally; fixed finger with prominent triangular tooth at  $\frac{2}{3}$



FIGS. 17-18. *Calocaris (Calastacus) oxypleura*, holotype male: 17, appendices interna and masculina with part of second pleopod; 18, anterior carapace in dorsal view. Scales: upper, 18 = 2 mm; lower, 17 = 0.25 mm.

length diverging outward from prehensile edge, proximal to it a row of widely spaced, fairly evenly distributed tuberculiform teeth, and distal to it a row of fine, irregular but much more closely spaced teeth. Left chela stouter, palm moderately inflated; dactyl stouter than fixed finger;

opposed edges of fingers with central diastema, proximal  $\frac{1}{4}$  of fingers armed with irregularly elongate sectorial teeth and weak molar complex on fixed finger, distal half of both with shearlike edges, tips broken. Carpus of each cheliped with 4 strong dorsal and 4 ventrolateral spines. Merus of right cheliped with 5 spines on inner crest and 1 laterally near articulation with carpus, left merus with 4 spines on inner crest; both meri with 2 spines on external crest (left proximal one broken). Each ischium with single curved spine on inner crest.

Remaining legs missing except for disarticulated, chelate left second; chela nearly bare on inner surface but clothed with long, dense setae elsewhere, most prominent on dactyl and along ventrolateral aspect; fingers bent ventrally at slight angle to palm, opposed edges spooned; dactyl about  $\frac{1}{3}$  length of palm; both carpus and merus slightly bent to fit curve of carapace, prismatic in cross section; distal third of carpus with long setae ventrally; external surface of merus covered with ciliated, transverse rugosities.

Biramous, setose pleopods on abdominal segments 2-5, lacking on first segment; endopod of each with appendix interna equipped with hooked setules at tip; second pleopod with an appendix masculina bearing long nonplumose setae along entire length, most dense distally.

Tail fan with dense, long, plumose setae on caudal margin (many broken) and scattered tufts elsewhere. Telson about  $\frac{1}{4}$  longer than wide, evenly rounded caudally; lateral margins with proximal lobate process articulating with uropodal endopods and armed with 4 spines, 1 surmounting lobate process, 2 well separated on middle reaches, and 1 at posterolateral corner; mesial to latter an unequal pair of movable spines; median longitudinal sulcus fairly broad; suggestion of a pair of submesial thickened longitudinal ribs in proximal half and on these a small submesial pair of proximal spines, larger spine near center on each side. Uropods as long as telson. Mesial branch with thickened longitudinal ribs, central rib bearing 4 nearly equidistant spines, caudalmost one nearly on terminal margin; lateral marginal rib with 4 spines progressively longer distally and strong spine at caudolateral angle (spine twinned and broken on right side). Lateral branch with transverse distal suture bordered by row of small spines; 2 thickened longitudinal ribs centrally; lateral margin with 4 unevenly spaced spines, distalmost flanked mesially by submarginal movable spine.

*Measurements in mm:* Carapace: length including rostrum, 18.8; width, 6.1; height, 7.0. Length abdomen and telson (estimate), 23. Length articles of first legs: right propodus, 21; right dactyl, 14.4; left propodus, 19.8; left dactyl, 10.0—of second leg: dactyl, 0.94; propodus, 2.94; carpus, 6.25; merus, 7.31.

*Type-locality:* [Straits of Florida W of Riding Rocks] 25°15'N, 79°13'W, 365 m, *Combat Stn.* 445, 23 July, 1957 (USNM 101651 holotype ♂).

*Name:* The name is from the Greek "oxys" acute, and "pleura" side, for the abdominal pleura with prominent acuminate tips.

*Remarks:* I have described this species with some hesitation because the imperfect holotype is the only specimen, but the characters are so distinctive that there seems little likelihood that it could be confused with another species. Specimens of most axiids are rare in collections, and knowledge of the group seems benefitted by any evidence available.

The specimen is well preserved but damaged mechanically. The rostral tip and tip of each antennal thorn have seemingly been jammed and pushed to the right. A number of spines on the carapace and appendages are broken, as are many setae. The legs present are disarticulated from the body and tips of the chelipeds broken off. The abdomen has been crushed and twisted, most damage inflicted on segments 4–6, splitting the terga and cracking some pleura. The lateral branch of the left uropod is missing.

The large chelae, though apparently worn, are distinctive in shape. The left chela is the major, and the right the slender, forcepslike minor. No other minor chela resembles this one among published illustrations of Axiidae or specimens available for study. The hand may be regenerated, but there is no evidence for or against this.

*Discussion:* In the western Atlantic, 3 species of *Calocaris* belonging to the subgenus *Calastacus* are now known from waters off the southeastern United States, the 2 described here and *C. hirsutimana* Boesch and Smalley, 1972, known also from Guyana. All have conspicuously bearded chelae. Boesch and Smalley (1972) found the gills of *C. hirsutimana* as listed for *Calocaris* by Gurney (1942: 149) except with “podobranch and arthrobranch on second maxilliped well developed and epipod of second pereopod lacking a podobranch.” The large male specimen of *C. hirsutimana* listed below agrees with Gurney’s gill formula except that legs 3 and 4 have epipods and that of 3 has a small podobranch. *Calocaris jenneri* has the same gill formula as *C. hirsutimana*; danger of breakage prevented examination of gills in *C. oxypleura*.

*Calocaris jenneri* is much less spinose on the lower palm of the chelae and along the edges of the pleura than *C. hirsutimana*, and it lacks the elongate antennal thorn and median spine on the telson; but *C. jenneri* does have much more prominently armed tooth rows and accessory spines on the chelae in both males and females (females of *C. hirsutimana* are unknown). While the long antennal thorn and somewhat setose carapace link *C. oxypleura* to *C. hirsutimana*, the acuminate tips on the pleura, open forcepslike chelae, and lack of a median spine on the telson clearly separate it from the latter. Boesch and Smalley (1972) drew parallels between *Axiopsis* and *Calastacus*, pointing out that irregularities in the middorsal keel make it a poor generic character, and related *C. hirsutimana* to 2 Indo-Pacific species of *Axiopsis*, implying thereby some importance in the long antennal thorn. *Calocaris jenneri* has a short antennal thorn yet shares other features with *C. hirsutimana*. It is clear that present generic definitions are inadequate.

*New locality record:* USNM 150475 *Calocaris* (*Calastacus*) *hirsut-*

*imana*, 1 ♂ (mature, broken), Tortugas shrimp grounds [Florida], fisherman, April, 1964, to D. Tabb, to A. J. Provenzano.

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*Addendum:* After this paper was in press a second male specimen was found in material from the then U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries R/V *Oregon*, Stn. 6460, 14°12'N, 81°57.5'W [Quita Sueño Bank off Nicaragua], 146 m, 2 December 1967, 66-foot trawl, by Michelle de Saint Laurent. The specimen agrees well with the holotype, is considered a paratype (USNM 151211), and differs in minor details as follows: Chelipeds and left fifth leg attached, remainder of legs missing. Carapace length 18.5 mm, extreme tip of rostrum broken, spines of rostrum asymmetrically arranged. Abdominal pleura with a few small submarginal tubercles laterally. Chelae with tracts of spines and/or spiniform tubercles on both inner and outer surfaces of palms in same position as tracts of tubercles in holotype; left (major) chela with tips of fingers each tapered to a point and curved toward each other, crossing when closed; right (minor) chela with similar tip on dactyl, tip of fixed finger broken; left carpus with 3, right with 4 ventrolateral spines; meri each with 5 spines on inner crest. Fifth leg slender; brush of long setae on dactyl; propodus with a few long, mesial setae on distal end, a dense patch of short setae terminally on lower margin, and an elongate patch of longer ones distolaterally; length of dactyl 1.3, propodus 4.1, carpus 3.2, merus 4.4, ischium 2.5 mm. Tail fan with dense fringe of long, plumose setae largely intact, minor differences from holotype in spination.

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